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MORPHOLOGY AND TAXONOMY OF ENTOMOPATHOGENIC NEMATODES IDENTIFIED IN POTATO AGROBIOCENOSIS IN UZBEKISTAN

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ABSTRACT: This research is dedicated to the taxonomy and morphobiological characteristics of entomopathogenic nematodes. It includes the study of various nematodes belonging to the class Secernentea, order Rhabditida, and its suborders Rhabditina and Cephalobina. Nematode species living in potato agrobiocenoses in various regions of the Surxondaryo province were identified.

KEYWORDS: Entomopathogenic nematodes, taxonomy, morphobiology, Steinernema, Heterorhabditis, Secernentea, Rhabditida, Strongyloidoidea, Rhabditoidea, biological control.

INTRODUCTION

Entomopathogenic nematodes residing in potato agrobiocenoses are microorganisms that feed on insects and are important for biological control. This article is dedicated to studying the species of nematodes residing in potato-growing areas of Uzbekistan and their morphobiological characteristics. Entomopathogenic nematodes play a vital role in regulating insect populations through their natural predators. They are distinguished by their high adaptability and versatility in different ecological conditions. Our research aims to identify nematode species in potato-growing regions of Uzbekistan and to study their morphological and taxonomic characteristics. The results of the research provide essential information for identifying entomopathogenic nematode species in potato agrobiocenoses and their potential use as natural enemies. Furthermore, this information could be beneficial in developing biological control programs in Uzbekistan. This research represents a significant step in enriching scientific knowledge in this field and developing future biological control methods.

MATERIAL AND METHODS

In our research to study the morphology and taxonomy of entomopathogenic nematodes residing in potato agrobiocenoses in Uzbekistan, scientific approaches and precise methodologies were employed. Potato fields in various regions of Uzbekistan were chosen as research sites. Seasonal collections of nematode samples were conducted, considering various ecological conditions and their interactions with insects.

Adams and Nguyen's (2002) methodologies were used for sample collection and preservation. Microscopic examinations were conducted for the identification of each nematode species, examining their morphological characteristics, including body length, width, structure, and other diagnostic features.

In addition to morphological analyses, modern genetic analysis methods were also used in determining nematode taxonomy. This involved isolating certain parts of the nematodes' DNA and examining their genetic characteristics using molecular markers. This method provided more accurate identification of nematode species.

Statistical methods were used in analyzing the data obtained during the research, allowing for an assessment of the reliability and overall significance of the findings. This part of our research will serve as a basis for future scientific studies on entomopathogenic nematodes in potato agrobiocenoses in Uzbekistan.

RESULTS

Microscopic analysis revealed the following morphological characteristics of the species:

Steinernema carpocapsae (Weiser, 1955): Males have a head region with six labial and four circular head papillae. The excretory pore is usually located in front of the nerve ring. The D% is 41 (27 - 55), and the tail is mucronate. The spicule's head part is elongated, widening from the abdomen. The spicule length is 66 (58 - 77) nm, with a spicule length to width ratio of approximately 5.2 (4.7 – 6.0). SW = 1.72 (1.40 - 2.0); GS = 0.71 (0.59 – 0.88). The gubernaculum narrows ventrally towards the front. Infective larvae have an average body length of 558 (438 - 650) nm. EP = 38 (30 -60) nm, E% approximately 60 (54 - 66). T = 53 (46 - 61).

Steinernema feltiae (Filipjev, 1934): Male specimens also have six labial and four circular head papillae in the head region. The excretory pore is positioned in front of the nerve ring. D% - 60 (51 - 64) with a long mucronate tail. The spicule's head part is elongated, and the spicule length to width ratio is approximately 1.5 - 2.0 nm. There is a spicule roller, but without a proboscis. The spicule length is 70 (65 - 77) nm, with a length to width ratio of 6.0 (5.8-6.2). SW = 1.1 (1.0 - 1.3); GS = 0.59 (0.52 – 0.61). The gubernaculum is boat-shaped in lateral view, with a narrow neck region. The distal part is short and Y-shaped. Infective larvae have an average body length of 849 (736 - 950) nm. EP = 62 (53 -67) nm, E% = 78 (69 - 86). T = 81 (70 - 92) nm.

Steinernema scapterisci (Nguyen & Smart, 1990): Males have six lab papillae in the anterior part of the body, slightly merging with four larger head papillae. The excretory pore is located slightly ahead of the nerve ring. D% approximately 38 (32 -44). The tail is conical and mucronate. The head part of the spicule is enlarged, forming a slight angle, and has a noticeable roller. The spicule length is 83 (72 - 92) nm. SW = 2.52 (2.04-2.80); GS=0.78 (0.69 - 0.84). The gubernaculum is boat-shaped. The distal part is scythe-shaped and Y-shaped. The female's genital canal is elliptically shaped and prominently located, displacing the rectum base to one side. The epiptigma is well developed. Infective larvae have an average body length of 572 (517 - 609) nm. EP = 39 (36 - 48) nm, E% = 73 (60 - 80). T = 54 (48 - 60) nm.

Steinernema scarabaei (Stock & Koppenhöfer, 2003): Males have paired spicules, symmetrical, with the manubrium (handle) diamond-shaped. Velum present. The gubernaculum is ribbon-shaped, with the tail of the first-generation males mucronate, while the second-generation has a rounded, mucronless tail. The reproductive system contains 23 papillae (11 pairs and one odd). D%

approximately 53 (53-77). The spicule length is 71 (67-83) nm. SW = 1.7 (1.5-2.0); GS=0.6 (0.50 - 0.65).

Heterorhabditis bacteriophora (Poinar, 1976): Males have a body width of 43 (38 - 46) nm. D% = 117 (115 - 124). The spicule length is 40 (36 - 44) nm, occasionally widening ventrally. The gubernaculum length is 20 (18 - 25) nm. SW = 1.74 (1.6 - 1.8); GS = 0.50. Infective larvae have an average body length of 588 (512 - 671) nm. The body width is 23 (18 - 31) nm. EP = 104 (94 - 109) nm, E% = 112 (103 - 130). ES=125 (100-139) nm. T= 94 (93 - 99). c = 6.2 (5.5 - 7.0). This species was first isolated from an insect cocoon in South Australia, which is particularly noteworthy.

Heterorhabditis indica (Poinar, Karunaka & David, 1992): Males have a body width =42 (35 -46) nm. EP = 123 (109 - 138) nm. ES = 101 (93 - 109) nm. D% = 122. The spicule length = 43(35-48) nm. The gubernaculum = 21 (18 - 23) nm. SW = 1.90 (1.80-2.00); GS = 0.49. Infective larvae have a body length of 528 (479 - 573) nm. The body width is 20 (19-22) nm. EP = 98 (88 - 107) nm. ES = 117 (109 - 123) nm, E% = 94 (83 - 103) nm. T = 101 (93 - 109) nm. c = 5.3 (4.5 – 5.6).

Heterorhabditis megidis (Poinar, Jackson & Klein 1987): Males have a body width =47 (44 -50) nm. EP = 156 (139 - 176) nm. ES = 128 (122 - 134). D% = 122. The spicule length is 49 (46 - 54) nm; without ventral expansion. The gubernaculum length is 21 (17 - 24) nm. SV = 1.88; GS=0.43. Infective larvae display a membranous ring around the oral cavity. The body length = 768 (736 - 800) nm. The body width = 29 (27 - 32) nm. EP =131 (123 - 142) nm.

CONCLUSION

This research conducted in Uzbekistan was dedicated to the morphology and taxonomy of entomopathogenic nematodes residing in potato agrobiocenoses. The findings encompass various nematodes from the Secernentea class, Rhabditida order, including the Rhabditina and Cephalobina suborders, featuring species like Steinernema and Heterorhabditis. Detailed morphological and genetic analyses of each species highlighted their adaptability to different ecological conditions and their potential significance in insect management.

The research provided clearer identification of entomopathogenic nematode species in potato agrobiocenoses. The morphological and genetic characteristics of these species, along with their distribution and ecology, offer crucial information. This data could play a primary role in developing and implementing biological control measures against insects in Uzbekistan. Additionally, these studies can assist in developing environmentally friendly and efficient methods to protect plants from pests in the future.

Consequently, this research marks a significant step in enriching scientific knowledge in the field of plant protection and pest control. It plays a key role in adopting sustainable and eco-friendly approaches in agriculture in Uzbekistan. Future research is needed to gain a deeper understanding of these species and improve their application in biological control.

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